REMARKS

The Final Office Action mailed March 20, 2006, has been received and reviewed. Claims 1 through 6, and 9 through 15 are currently pending in the application and stand rejected. Applicant proposes to amend claim 1. No new matter is added. Reconsideration is respectfully requested.

Power of Attorney

Applicant notes that a Revocation of Power of Attorney, New Power of Attorney and Change of Correspondence Address was submitted to the Patent and Trademark Office on March 28, 2005. (A copy of the documents with the corresponding return postcard is enclosed herewith). While Joseph A. Walkowski of TraskBritt is indicated on the PAIR site as an attorney of record, **the correspondence address is incorrect and applicant's prior attorneys are still listed.** Applicant respectfully requests that the change in Power of Attorney **and correspondence address** be entered.

35 U.S.C. § 103(a) Obviousness Rejections

Obviousness Rejection Based on U.S. Patent No. 5,847,461 to Xu *et al.* in view of U.S. Patent No. 6,217,721 to Xu *et al.* and U.S. Patent No. 5,869,395 to Yim

Claims 1 through 6, and 9 through 15 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Xu *et al.* ("Xu '461") in view of Xu *et al.* ("Xu '721") and Yim (U.S. Patent No. 5,869,395). Applicant respectfully traverses this rejection, as hereinafter set forth.

M.P.E.P. 706.02(j) sets forth the standard for a Section 103(a) rejection:

> To establish a *prima facie* case of obviousness, three basic criteria must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or combine reference teachings. Second, there must be a reasonable expectation of success. Finally, **the prior art reference (or references when combined) must teach or suggest all the claim limitations.** The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, and not based on applicant's disclosure. *In re Vaeck*, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991). (Emphasis added).

Xu '461 teaches an integrated circuit structure having an insulating layer 10 formed over integrated circuit structure 2. Openings 14 and 16 are formed in insulating layer 10 and extend downwardly from upper surface 12 of the insulating layer 10 to expose surfaces 4 and 6 of integrated circuit structure 2 at the bottom of the openings 14 and 16. A barrier layer 20 is formed over upper surface 12 and insulating layer 10 as well as over the side walls of openings 14 and 16 and over exposed surfaces 4 and 6 at the respective bottoms of openings 14 and 16 (Xu '461, col. 3, lines 12-22). A metal layer 30 comprising a layer of compressively stressed metal is subsequently extruded down into openings 14 and 16 (*Id.*, co. 4, lines 17-23). A cap layer 40 is formed over is formed over metal layer 30. The cap layer 40 of compressively stressed metal is formed over metal layer 30. The cap layer 40 comprises a high tensile strength material to restrain the upward movement of metal layer 30 during the subsequent extrusion step. (*Id.*, col. 6, lines 26-34).

Xu '461 teaches that seed layers are undesirable when filling small openings and is directed toward other methods of filling the contact openings. (*Id.*, col. 1, line 56 – col. 2, line 27). The Examiner acknowledges that Xu '461 fails to teach or suggest a seed layer. (Office Action mailed March 20, 2006, page 7). While Xu '461 focuses on the limitations of tungsten as a seed layer, its teaching that that seed layers add "further deposition and planarization steps, resulting in more cost, and less reliability" would apply to seed layers generally. (*Id.*, col. 2, lines 7-9). Thus, Xu '461 proposes a method to "fill very small diameter openings in an insulating layer with metal such [as] aluminum **initially deposited on the surface of the insulating layer**." (*Id.*, col. 2, lines 19-22, emphasis added).

Yim discloses a method of creating interconnects, but fails to teach or suggest using a seed layer.

Xu '721 teaches an alternative method of filling contact holes 140. A PVD process is used to coat a liner layer 152 onto the sides of a contact hole 140. The liner layer 152 may include a first sublayer 160 of titanium silicide, a second sublayer of titanium nitride 162 and a third sublayer of titanium 164 (deposited as titanium nitride). (Xu '721, col. 12, line 50 – col. 13, line 6; FIG. 8). Standard PVD then deposits a metal layer 156 over the third sublayer 164.

Applicant respectfully submits that the proposed combination of references fail to teach or suggest every element of the presently claimed invention. Claim 1 of the presently claimed invention recites a "method for manufacturing an interconnect structure consisting essentially of: forming a recess within a dielectric material situated on a semiconductor substrate, the recess extending below a top surface of the dielectric material; forming a diffusion barrier layer substantially conformally on the top surface of the dielectric material and over an interior surface of the recess; forming a seed layer on the diffusion barrier layer over the top surface of the dielectric material and within the recess, the diffusion barrier layer comprising a material having a melting point greater than or equal to that of a material comprising the seed layer, wherein the material comprising the seed layer consists of aluminum, titanium nitride, titanium, or titanium aluminide; forming an electrically conductive layer on the seed layer over the top surface of the dielectric material and substantially within the recess such that voids are present within the recess, the material comprising the diffusion barrier layer having a melting point greater than that of a material comprising the electrically conductive layer, the material comprising the seed layer having a melting point greater than or equal to that of the material comprising the electrically conductive layer; forming an energy absorbing layer on the electrically conductive layer, the energy absorbing layer having a greater thermal absorption capacity than that of the electrically conductive layer; applying energy to the energy absorbing layer sufficient to cause the electrically conductive layer to become molten and fill the voids within the recess; and removing portions of the energy absorbing layer and the electrically conductive layer that are situated above the top surface of the dielectric material." Support for the amendments can be found throughout the as-filed specification, for example, page 12, lines 7-14.

Applicant respectfully submits the proposed combination of references fail to teach or suggest "forming an electrically conductive layer on the seed layer over the top surface of the dielectric material and substantially within the recess such that voids are present within the recess" and "applying energy to the energy absorbing layer sufficient to cause the electrically conductive layer to become molten and fill the voids within the recess" as recited in claim 1 of the presently claimed invention. Instead, the references lack any teaching or suggestion of forming an electrically conductive layer on the seed layer over the top surface of the dielectric

material and substantially within the recess such that voids are present within the recess." Xu '461 teaches that aluminum layer 30 does not initially extend within the recess. (FIG. 2).

Further, the references fail to teach or suggest "applying energy to the energy absorbing layer sufficient to cause the electrically conductive layer to become molten and fill the voids within the recess." Xu '461 teaches that the structure should be heated "to a minimum temperature at which plastic deformation of metal layer 30 will occur, but lower than the melting temperature of metal layer 30." (Xu '461, col. 7, lines 1-8). Xu '761 and Yim lack any similar teaching or suggestion.

Additionally, no motivation exists to combine the two Xu references. Xu '461 teaches that the initial aluminum layer 30 does not extend within the recess. (FIG. 2) Xu '721 discloses completely filling the via by a PVD process. Thus, assuming the liner layers 152 of Xu '721 could be incorporated into the structure of Xu '461, which applicants do not concede, no reason would exist to fill the via by applying heat and extruding the metal as disclosed in Xu '461. The two Xu references teach alternative methods of filling a contact structure and no motivation exists to combine portions of the first method (i.e., Xu '461) with a second distinct method (i.e., Xu '721).

As the proposed combination of references fail to teach or suggest every element of independent claim 1 of the presently claimed invention, the proposed combination of references cannot render independent claim 1 of the presently claimed invention obvious. Thus, claim 1 is allowable.

Claims 2- 6 and 9 – 15 are each allowable as depending, either directly or indirectly, from allowable claim 1.

ENTRY OF AMENDMENTS

The proposed amendments to claim 1 above should be entered by the Examiner because the amendments are supported by the as-filed specification and drawings and do not add any new matter to the application. Further, the amendments do not raise new issues or require a further search. Finally, if the Examiner determines that the amendments do not place the application in condition for allowance, entry is respectfully requested upon filing of a Notice of Appeal herein.

CONCLUSION

Claims 1-6 and 9-15 are believed to be in condition for allowance, and an early notice thereof is respectfully solicited. Should the Examiner determine that additional issues remain which might be resolved by a telephone conference, he is respectfully invited to contact Applicant's undersigned attorney.

Respectfully submitted,

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